The Physiology of Political Participation

Michael W. Gruszczynski

Amanda Balzer

Carly M. Jacobs

Kevin B. Smith

John R. Hibbing

University of Nebraska-Lincoln

Abstract:

Political involvement varies markedly across people. Traditional explanations for this variation tend to rely on demographic variables and self-reported, overtly political concepts. In this article, we expand the range of possible explanatory variables by hypothesizing that a correlation exists between political involvement and physiological predispositions. We measure physiology by computing the degree to which electrodermal activity changes on average when a participant sequentially views a full range of differentially valenced stimuli. Our findings indicate that individuals with higher electrodermal responsiveness are also more likely to participate actively in politics. This relationship holds even after the effects of traditional demographic variables are

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taken into account, suggesting that physiological responsiveness independently contributes to a fuller understanding of the underlying sources of variation in political involvement.

The discipline of political science has long viewed the normative standard of rationality as the key to understanding participation in the democratic sphere (see Downs 1957; Aristotle 2010) and an important element of rationality is typically assumed to be conscious awareness. People are presumed to be aware of the “rational” reasons for their political choices. Relatedly, citizens making decisions in a democratic society have traditionally been expected to eschew their base emotional predispositions—fear, anger, happiness, and others—in favor of using the rationality made possible by their frontal cortex (Neblo 2007). For example, it is often assumed that people will participate in politics only when they ***believe*** (note the presumption of conscious thought) it is worth their time (Downs 1957). This line of thinking is so prevalent historically that the founders themselves argued for building institutions capable of protecting political society against the foibles of an emotional citizenry (Hamilton, Madison and Jay 1788). The conceit seems to be that if people are neither visibly displaying emotion nor consciously feeling the effects of emotion, politics will be the better for it.

These normative standards frequently do not correspond to empirical observations, as an ever-increasing body of research demonstrates that the supposed battle between emotion and rationality constitutes a false dichotomy (see Hanoch 2002; McDermott 2004). Spezio and Adolphs (2007) note that the emotional and cognitive portions of the brain, rather than working against one another, cooperate in a system resembling a feedforward network, with emotional appraisal acting as an information processer, passing some information upward for cognitive elaboration while other information is never passed on to conscious awareness. Damasio and

Damasio (1994) show that without limbic responses the rational cortex has difficulty going beyond listing the pros and cons to making and acting upon an actual decision.

This symbiotic relationship of emotion and cognition (and by inference the vital role of affect) is increasingly recognized in recent work on political behavior. Negative emotions such as fear or threat, as well as more neutral emotions such as anxiety, lead citizens to pay more attention to political information, while anger, it would appear, leads to a reliance on past attitudes and behavior (Marcus, Neuman, and MacKuen 2000; Brader 2005; Geer 2006). Further evidence, both pro and con, on the role of emotions in politics is provided by Ladd and Lenz 2008, Marcus, Neuman, and MacKuen 2011, Brader 2011, and Valentino et al. 2008.

This important and rapidly growing research stream on politics and emotions is characterized by two noteworthy features; first, an emphasis on the potential relevance of discrete, relatively narrow emotions such as anger, anxiety, fear, happiness, or sadness; and second, measurement approaches that require research participants to self-report their felt emotions ("did [a particular event] make you feel angry/fearful/anxious?"). To take one example, Valentino et al. 2008 examine the influence of self-reported anger (in response to a defined political situation) on political behavior.

Valuable as this general research design continues to be, it does not capture all of the possible "non-rational" influences on political behavior. Accordingly, our approach is designed to add to existing knowledge by making the following changes in approach. First, instead of testing for the effects of a particular emotion we are interested in the possible effects of a broader construct that could be called general predisposition to engagement (see Osgood, Suci, and Tannenbaum 1967; Marcus 2003). We focus on this broad-based concept, not because we believe discrete categories of stimuli have no unique effects (they obviously do), but because we believe individuals may also vary in pan emotional response patterns. We think of this concept as predisposing individuals to engage rather than to demur (see McDermott 2004; Marcus 2003). Cross-emotional constructs such as this have been associated with the intensity or drive that underlies the extent to which engagement occurs (Bradley 2000; Brehm and Self 1989), greater performance in attention tasks (Matthews, Davies, and Lees 1990), and greater memory recall when viewing television advertisements (Lang, Dhillon, and Dong 1995), especially negative political advertisements (Bradley, Angelini, and Lee 2007). It seems reasonable to hypothesize that this heightened attention and awareness also will be accompanied by greater psychological engagement.

Second, instead of relying on survey self-reports of felt emotion, we utilize physiological measures. This is an important shift and merits further explication. Asking people about the particular emotions they may be feeling is a sensible approach, yielding useful and meaningful findings, but this procedure does not measure the totality of people's responses. After all, emotions are defined as "feelings" or, put differently, as "the affective aspect ***of consciousness***" [emphasis added] and it has been demonstrated repeatedly that elements of people's response to the environment occur outside of consious awareness. This statement is true in all areas including politics. For example, a growing body of empirical results shows that political decisions are affected by subliminal word prompts (Strahan, Spencer, and Zanna 2002); nearby objects of which the decision-maker is not consciously aware (Helzer and Pizarro 2011), and even hypnotic suggestion (Wheatley and Haidt 2005). Galdi, Luciano, and Gawronski (2008) demonstrate that implicit attitudes (that is, attitudes of which the individual is not aware) affect voting decisions. In short, much of what is going on in the human nervous system is occurring outside of conscious awareness.[1] Humans simply are not built with the ability to describe their full physiological state at any given time and reports of conscious "feelings" must be viewed as only one slice of this larger condition (see Bargh and Chartrand 1999; Wegner 2002; Lodge and Taber 2005; Gazzaniga 2012).

Moreover, many facts and feelings of which people believe they are consciously certain turn out to be completely incorrect (eyewitness testimony is a prime example; see also Deese 1959; Redlawsk et al. 2010). Given that responses to the environment do not always register consciously, measures of response using only individual self-reports of felt emotions are incomplete. Since physiological measures rely on readings from sensors and not on self-reports of feelings, they hold the promise of tapping certain elements of response occurring outside of conscious awareness. By employing this type of measure, small but important advances will be possible in understanding the large portion of the decision-making process occurring outside the realm of consciously rational thought.

We believe that research on broad, physiological responsiveness has the potential to combine with research on individual, conscious, felt emotions to offer a fuller account of the role of conscious and subconscious responses in shaping political behaviors and orientations. In fact, it may be that when variability in broad physiological responsiveness is brought into the equation, empirical support for the effects of discrete, self-reported emotions will be enhanced. For example, Rudolph, Gangl, and Stevens (2000) find that the interaction of emotions generated by a campaign and broader orientations regarding efficacy affects political attitudes. Mondak et al. (2010) report a variety of interactions with broad personality traits and discrete, politically

[1] Evolutionary psychology offers sensible reasons that portions of human response should register outside of conscious thought. For example, some needed responses may be quicker and more direct without the involvement of consciousness (e.g., pulling one's hand from a fire prior to realizing that the hand is burning) and sometimes keeping information out of conscious awareness prevents overloading.

relevant situations that affect political participation. And Smith et al. (2011) provide evidence that self-reported sensitivity to disgust and physiological responses to disgusting stimuli independently predict political attitudes on select issues, suggesting that both felt emotions and unfelt physiological responses are relevant to politics. Thus the goal here is to encourage the addition of physiological measures to self-reports and not to suggest that these two distinct measurement approaches are competing.

Causal Order and Theoretical Value

Causal forces are sometimes inappropriately and hastily ascribed to variables evincing a more biological bent so it is important to note that biology does not always precede higher level decisions just as higher level decisions do not always precede biology. Like most political science research, ours is merely correlational and, like most political science research, attribution of causal order can only be done provisionally and on the basis of theory. In the analysis to follow, the two main variables of interest are broad physiological responsiveness and political participation. We can and will provide empirical evidence that these two variables are positively correlated; we cannot provide empirical evidence that one causes the other. Readers should bear in mind that, as is the case with all regression equations, designation of one variable as "dependent" and others as "independent" is a selection made by the researchers on the basis of their theoretical understanding of the relationship. Sometimes this selection is easy, as when one variable clearly is temporally antecedent to the other or when controlled, experimental interventions are involved, but in most situations judgments must be made. Invoking biological measures in no way alleviates the need to rely on theory in order to come to grips with the likely causal order.

On the basis of theory as well as the assertions and practices of previous scholars, we construct our regression models with political participation as the dependent variable and broad physiological responsiveness as the explanatory variable. We will explain our logic in a moment but readily admit that other theoretical stories could be spun and we encourage readers to do so. Adjudicating among these possibilities will not be easy but will be possible with longitudinal designs (manipulating broad physiological responsiveness in a lab setting would be challenging but may also be possible). Happily, we believe the correlational relationship we identify is interesting no matter what the causal order. In other words, if broad, physiological responsiveness precedes political participation, as our regression models assume, it would suggest that physiological traits need to be considered by political scientists (and others) who are eager to understand fully the reasons some individuals engage in the political arena and some do not. If, on the other hand, it is eventually demonstrated that an individual's degree of political participation causes changes in that individual's physiological responsiveness to all manner of stimuli, from toasters to toilets and from sunsets to skiers, that would be a remarkable and surprising result, suggesting that political participation causes an entire array of non-political responses, such as elevated skin conductance in response to seeing a wicker basket.

We believe the breadth of our physiological responsiveness measure, covering so many types of images, none of which is particularly political, encourages the causal order we suggest. In their study of the effects of disgust on political attitudes, Inbar, Pizarro, and Bloom put it well: "it seems unlikely political attitudes would shift a person's general emotional dispositions, particularly when it comes to … a basic emotion that emerges long before individuals form political attitudes" (2009: 21). Though it is undoubtedly the case that salient political events can affect the physiology of people who care deeply about politics—witness the evidence that individuals' endocrine levels can be affected by whether their candidate for president wins or loses (Stanton et al. 2010), the case being considered here is somewhat different in that physiological readings were not taken in proximity to a political event. Indeed, as mentioned before, the stimuli were decidedly non-political. To be sure, none of this rules out the possibility that political participation could cause alterations in broad physiological responsiveness but we do feel the somewhat strained nature of this alleged relationship gives us some justification for hypothesizing the causal order we do. This certainly is the direction of the relationship hypothesized by the few existing studies connecting individual-level physiological variations to political variables (Amodio et al. 2007; Oxley et al. 2008; Kanai et al. 2010; Smith et al. 2011).

Moving beyond "which comes first" in order to elaborate on our deeper theoretical vision, we believe that physiological measures such as the one we are about to employ are the best routes to achieving an indication of the "running tallies," "standing decisions," "habits," "predispositions," "motivated social reasoning," "automaticity," "longstanding dispositions," and "antecedent conditions" that have long been seen as crucial to political decisions (Jost et al. 2003; Lodge and Taber 2005; Zaller 1992; Mondak 2010; Plutzer 2002; Gerber, Green, and Shachar 2003; Fowler 2006; Prior 2010; Marcus et al. 1995; Galdi, Luciano, and Gawronski 2008). Though they frequently deny it, people do indeed typically enter political situations with predispositions and biases—some conscious and some not. Whether these longstanding predispositions are the result of genetics, early developmental events, more proximate environmental experiences, or, as seems likely some mix of these sources, measuring dispositions is challenging. This situation is no doubt why, after identifying the importance of longstanding forces, most research quickly adds that "understanding the source of these dispositions is beyond the scope of this study" (Zaller 1992: 23; Barker and Tinnick 2006: 251). Given the fact that these biases and predispositions are often not in the realm of conscious awareness and therefore difficult to measure with traditional approaches, such a strategy makes perfect sense. Still, the repeated findings demonstrating the importance of these subthreshold biases, standing decisions, and implicit attitudes suggest that at some point the effort must be made; otherwise, the discipline will only be able to understand the ephemeral forces that push people around their political "set point" without ever discovering more about the powerful standing decisions themselves.

Physiology holds some promise here. After all, even though these standing decisions are not in the realm of conscious awareness, they may retain some tangible presence that physiology can reveal. The logic is simple: Certain incidents flit into consciousness but fail to alter physical response patterns in a tangible manner. Other events leave their mark, sometimes without even entering people's conscious awareness (see Lodge and Taber 2005), building on previously retained dispositions and becoming incorporated into the way the body responds to subsequent situations. Physiology in this sense quite literarily embodies longstanding predispositions. Physiology can and does change but is at the same time a powerful source of inertia; established patterns written into physiology become behavioral defaults. Change is not something that occurs willy-nilly but rather requires sensory detection and then the overriding of established patterns (Gray 1990; Marcus, Neuman, and MacKuen 2000). Viewing longstanding political predispositions as physiologically based thus makes a good deal of sense. In fact, it is difficult to conceive of a meaningful political predisposition that is ethereally mentalistic and entirely devoid of any physical signature; mental states, even those outside of conscious awareness, are known to have measurable body characteristics (Smith and Hibbing 2011; Cacioppo, Tassinary, and Berntson 2007).

This conception is given support by virtue of the fact that those physiological measures that have been tested over time are reasonably stable (usually the length of time between the test and re-test is months but sometimes is as much as a year) and even appear to be heritable (on electrodermal activity, see Schell et al. 2002; Crider et al. 2004; on startle eyeblink, see Lee et al.

2009; Quevado et al. 2010). No analyses to date look at the stability of the particular physiological measure we employ here but at least the weight of evidence indicates a stickiness to physiological variables that can be seen as parallel to the stickiness of political orientations. No measure is perfect but physiological indicators may be able to provide some compass on the sub-threshold standing biases that heretofore have defied most measurement attempts. In this vein, it may be possible to move beyond demonstrations of the importance of motivated reasoning to understanding individual variations in particular motivations.

Measurement and Procedures

Human phsyiology is amazingly diverse. The body has many systems and changing activity levels in one system often do not correlate well with changing activity levels in another. We will employ just one of these many measures but readers should bear in mind that additional measures will be necessary before more complete assessments are possible. The particular physiological measure we employ is based on electrodermal activity (EDA). EDA manifests itself as small increases in the secretion of sweat at various points on the body; most research, including our own, measures EDA at the fingertip (see Dawson, Schell and Filion 2007). EDA is especially appropriate for our purposes because other physiological systems, such as the cardio-vascular, lie under control of both the sympathetic nervous system (SNS) and the parasympathetic nervous system. EDA, on the other hand, lies entirely under SNS control (Dawson, Schell and Filion 2007). As a result, EDA increases are widely accepted in the psychophysiological community as reliable indicators of arousal (Kreibig 2010) and as linking closely "with the psychological concepts of emotion, arousal, and attention" (Dawson, Schell, and Filion 2007). The highly questionable use of EDA as an indicator of whether or not a single, designated individual is telling the truth should not be confused with its acknowledged value as an indicator of the situations under which a group of people, on average, is physiologically aroused.

EDA has been widely used in the field of psychophysiology to get at, for example, overall cognitive engagement with one's environment (Nikula 1991), task vigilance (Dawson, Filion and Schell 1989), and conditioned anxiety among those individuals suffering from post-traumatic stress disorder (Blechert et al. 2007). In terms of political behavior more specifically, EDA has been used as a measure of disgust response that predicts support for sexual morality policy (Smith et al. 2011), as a gauge of threat response to predict support for socially protective policies (Oxley et al. 2008), and as a measure of anxiety in the face of negative political campaigning (Mutz and Reeves 2005).

It should be noted that, in and of itself, EDA is incapable of indicating valence (and this is one of the reasons it is problematic as a lie detector). Both an image of a snake and an image of a loved one typically increase EDA. Though this situation can be a problem for some research designs, the goal here, as stated above, is to acquire a broad measure of physiological response and not one that is keyed to, or strives to measure, responses to a discrete category of stimulus content. Thus, to obtain our measure of broad EDA response, we recorded mean changes in EDA of each participant occasioned by the presentation of a lengthy series of very diverse still images. We know the stimuli were diverse because an independent panel of 126 individuals rated their own emotional responses to these images in terms of valence, with one being "happy/positive feelings" and nine being "unhappy/negative feelings," and also on intensity, with one being "no reaction" and nine being a "strong reaction." The valence ratings ranged from a mean of 1.83 (SD=1.178) for an image of a sunset to 8.42 (SD=.924) for an image of an anorexic woman. Strength of emotional reaction ranged from a mean of 2.79 (SD=2.01) for a clean toilet to 8.11 (SD=1.208) for the anorexic woman. The raters also were asked to select specific emotions that were elicited by each image, which resulted in an assortment of reported, evoked emotions, including happiness, disgust, satisfaction, amusement, anger, fear, sadness and anxiety. The ratings show that the images selected for presentation run the gamut from decidedly positive (sunset, bowl of fruit, smiling child, cute animals) to decidedly negative (wounds, vomit, physical fights and dangerous animals). Each image appeared for 12 seconds on a computer screen directly in front of the participant and was preceded for approximately 10 seconds by a fixation point on a blank screen.

Because individuals vary dramatically in their pre-stimulus EDA levels, and because our focus is on the degree of response, we constructed a ratio of change in EDA for each individual by dividing the average skin conductance level (SCL) during presentation of each stimulus by the SCL obtained during the previous inter-stimulus interval (or ISI). Thus, at stimulus onset, increases in SCL relative to the previous ISI provide a ratio above 1, while decreases will produce a ratio below 1. We then calculated overall tendency to display physiological arousal by computing the mean change in this ratio across all non-political images for each participant. These procedures are standard in EDA analyses and the mean magnitude of the EDA response we recorded for our sample is typical (see Dawson, Schell, and Filion 2007). What is perhaps less typical is our practice of averaging this response across such a wide range of images in order to get a broad measure of EDA responsiveness. As argued above, however, we believe that doing so will provide both useful information on its own and also a valuable baseline against which physiological responses to particular categores of stimuli can be compared.

Our basic measure of political participation was obtained from a survey that participants completed long before the physiological exercise. Participants were presented with 11 items bearing on political participation, with a particular bent toward issue-driven participation: "how often do you discuss issues with other people," "are you registered to vote," "do you usually vote in elections," "do you feel strongly about political issues," "have you voted for particular candidates because of their position on a political issue," "have you campaigned for particular candidates," "have you contributed money to particular candidates," "have you contacted elected officials to encourage them to support a position on a political issue," "have you tried to persuade other citizens to support a position on a political issue," "have you joined an organization that promotes a position on a political issue," and "have you attended meetings that promote a position on a political issue." The item gauging frequency of political discussion was a five-point scale but all of the others were dichotomous "yes-no" items. Each of the individual items was standardized and factor analyzed using principal-components factoring, with an overall measure of political participation created by multiplying respondents' scores on each item by its factor loading and summing the products of the individual participation items together.[2] Weighting the individual participation items by their factor scores makes it possible to create a participation index that includes only the items' shared correlation with the underlying construct of political participation while discarding the portion of covariance not explained by that construct.[3]

Participants in this project were obtained in the following manner. We contracted with a professional survey organization to randomly contact individuals within convenient distance from Lincoln, Nebraska, to see if they would be willing to travel to our lab for a 90 minute session in exchange for $50. In this fashion, 200 subjects were recruited and completed an extensive,

[2] We used a 1-factor solution from the principal-components factor analysis to create the overall participation index. The factor loadings for each of the individual participation measures were as follows: register to vote (.468), vote (.639), frequency of political discussion (.759), feel strongly about an issue (.819), issue voted (.824), campaigned for a candidate (.599), contributed money (.651), contacted elected officials (.658), attempted to persuade others (.817), joined a political organization (.736), and attended meetings on an issue (.583).

[3] As a check we also created a version of the participation index by standardizing and summing the individual items without weighting. This measure correlated very highly with the principal-components-derived measure of participation ($r = .974$, $p < .001$) and, as might be expected given the high correlation coefficient, did not produce substantively different results than those produced by the factor-derived measure of participation.

computer-based survey of their political beliefs, personality traits and demographic characteristics. This is the survey that included the items on political participation mentioned above. It was intended that these participants would serve as a pool from which we could recruit smaller groups for physiological testing as money and lab time became available. Several months after the larger group completed the survey, 37 individuals with relatively strong political ideologies (either liberal or conservative) were invited back. A year later 51 additional participants from the pool were invited back, with this group consisting of some who were politically disinterested and uninvolved and others who were more engaged in the political process. We make no claim that these 88 individuals constitute a random sample. Their willingness to travel to participate in lab exercises on two separate occasions, for example, is an obvious source of bias. Still, for our purposes recruiting a purely random sample is less crucial than securing a group of people with a wide range of political participation levels.

On the second trip, research participants were brought to our physiology lab one at a time and sensors measuring EDA were attached to the distal phalanges (fingertips) of the index and middle fingers on participants' non-dominant hand. After an acclimation period, the series of images was presented. The participant was not required to perform any behavioral task—only to pay attention to the images on the screen. Data from two participants were not usable. One was discovered to have a health problem and the readings for the other were corrupted perhaps because of a misplaced or malfunctioning sensor.

(Table 1 about here)

Table 1 provides descriptive statistics for the participation index and for the standard sociopolitical variables. As mentioned, individuals in the 2007 study were recruited because they possessed strong ideologies while the 2008 group was more diverse and these facts are reflected in the relatively high mean participation index for the 2007 participants; the mean value of the participation index for the 2008 group is negative because the variables were standardized prior to executing the principal-components factor analysis. Mean age in both samples was just over 40 years old, income levels averaged in the $40,000 - $60,000 range and respondents tended to have completed at least a few years of college. Finally, similar numbers of males and females were recruited overall, though there is some unevenness within each individual year.

Results

Given that different images were presented to participants in 2007 and participants in 2008 and given the differences in the mean participation levels of the respondents in each year, we include a dummy variable for year (group) in our baseline analysis. We conducted ordinary least squares regression for four separate models, shown in Table 2. Model 1 included only traditional sociopolitical variables (age, gender, income, education) as well as the year of each group (2007 or 2008). As can be seen, the dummy for year performs as expected, picking up the higher participation levels of the 2007 group. Controlling for this effect in a multiple regression model, education was the only significant predictor of participation, with increasing levels of education not surprisingly associated with higher scores on the participation index ($b = 1.007$, $p < .05$).

(Table 2 about here)

Model 2 includes the aforementioned sociopolitical variables but adds our measure of EDA responsiveness into the mix. As before, education has a significant and positive relationship with participation but now we see that EDA responsiveness also contributes significantly and positively to the model ($b = .225$, $p < .05$).[4] Adding EDA responsiveness nets a significant change in the variance accounted for by the model ($\Delta R^2 = .033$, $p < .05$).[5] In fact, an examination of effect sizes reveals an especially interesting finding: education, so often the most important predictor of political participation, contributes little more to the model ($r = .25$; partial $\eta^2 = .07$) than does EDA responsiveness ($r = .23$; partial $\eta^2 = .06$).

Finally, we estimated separate models for the demographic and physiology variables by year, shown in Model 3 (2007) and Model 4 (2008). The fit for Model 3 (2007) is not significant ($p = .256$), likely due to the combination of a small sample size and a lack of variance in the dependent variable for that year (recall that participants in 2007 were selected for their strong political views). Even so, the effect size for EDA responsiveness in Model 3 remains the highest of any variable in the model, a not inconsequential $r = .29$; partial η^2 of .10. Model 4, which includes only those participants from 2008, retains a significant model fit. Both education and EDA responsiveness are significant ($p < .05$ and $p < .10$, respectively) and, in fact, both contribute substantially to the model in terms of their effect sizes ($r = .35$ and $r = .24$, respectively; partial $\eta^2 = .13$ and $\eta^2 = .06$). Education is a crucial predictor of political participation but even when controlling for education, EDA responsiveness remains important as well.

These connections between education, EDA responsiveness (easily the two strongest variables in all of the models), and political involvement merit further consideration. Both

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[4] The measure of EDA responsiveness was divided by 1,000 to make the size of the coefficient closer to that for the other variables.

[5] Because tests of increment to R^2 favor the partitioning of variance to variables entered into the model first, this is a conservative test of whether physiological variable contributes meaningfully to our understanding of political participation.

theoretically and empirically, educational levels and EDA responsiveness are reasonably distinct concepts. Education is likely to be capable of stimulating political involvement regardless of an individual's EDA responsiveness just as EDA responsiveness is likely to be capable of enhancing political involvement regardless of an individual's educational level. As such, we hypothesize that each of these concepts can compensate for the other. EDA responsive people are likely to get involved in politics; educated people are likely to get involved in politics; but those lacking both will be doubly disadvantaged and are likely to demonstrate the lowest levels of political involvement. Previous research suggests the value of interacting biological and environmental variables (Caspi et al. 2003; Fowler and Dawes 2008), and we are in a position to further empirical findings along these lines. Given the differences in the 2007 and 2008 groups, we tested our hypothesis by creating 2– and 3–way interactions between education, physiological responsiveness and year. Given that introducing interaction terms often leads to multicollinearity between the individual predictors and their products, we centered the education and physiological responsiveness variables prior to creating interaction terms (see Neter, Wasserman, and Kutner 1989). If we are correct, the interaction between education and EDA responsiveness should be negatively related to political involvement. The results are presented in Table 3.

(Table 3 about here)

With small N studies such as ours, results should be taken as provisional—particularly when they involve interaction terms. Still, the results presented in Table 3 are suggestive. Physiological responsiveness continues to show a significant main effect and continues to be associated with greater levels of participation. However, the previously significant main effect for education is not significant in the interaction model. More to the point, the interaction between education and EDA responsiveness is indeed negatively–signed, meaning that EDA responsiveness has the largest effect among those individuals with the least education and that education has the largest effect among those individuals with the lowest levels of EDA responsiveness. Individuals with low EDA responsiveness and low levels of education display remarkably low levels of political participation relative to the rest of our sample. Provisional as they are, the results in Table 3 do provide an indication of the potential value of interacting biological variables with the type of variables traditionally analyzed by political scientists.

(Table 4 about here)

The index of participation used in Tables 2 and 3 combines a broad range of activities and previous research on participation demonstrates that specific conditions and traits may have variable effects on individual types of participation (see Verba, Schlozman and Brady 1995). As a result, we tested for the effects of EDA responsiveness on individual modes of participation. Given the need to preserve degrees of freedom, Model 2 from Table 2 serves as our baseline model and the one we estimate for the individual elements of political participation. In Table 4, we report logistic regression models for the 10 dichotomous measures of participation. Similar results (not reported) were obtained for discussion, the only non-dichotomous measure in our participation index. After controlling for standard sociopolitical variables, increases in EDA responsiveness are associated with increased odds of participating in each of the individual political acts and this relationship is significant for registering to vote ($p = .052$), voting ($p = .026$), campaigning on an issue ($p = .032$), contacting officials about an issue ($p = .013$), and, marginally, for attending meetings on an issue ($p = .091$). The strength of the relationship with overall participation seems to be coming from voting, campaigning, and contacting but no type of involvement is negatively affected by higher levels of EDA responsiveness.

Conclusion

This study of the correlates of political involvement departs from existing research in several ways. Perhaps most importantly, it uses physiological measures to explain political phenomena, a practice that was encouraged by the pioneering work of Wahlke and Lodge (1972) but which was not much employed until recently (Lieberman, Schreiber, and Ochsner 2003; McDermott 2004; Mutz and Reeves 2005; Boudreau, Coulson, and McCubbins 2009; Soroka and McAdams 2010; Hatemi and McDermott 2011). Physiological measures of autonomic nervous system activity are potentially valuable because, though previous work amply demonstrates that people's self-reports of their feelings and emotional states are relevant to important political outcomes, much that is occuring in the human mind and body is outside the realm of conscious thought and thus not captured by survey self-reports.

Further, our study solicits participants' responses to emotional stimuli generally rather than to discrete categories of stimuli such as disgust or fear or anxiety (Inbar, Pizarro, and Bloom 2009; Feldman and Stenner 1997; Valentino et al 2011; and Marcus, Neuman, and MacKuen 2000). We refer to this concept as broad physiological responsiveness and suggest that research on discrete emotions may be enhanced by taking into consideration an individual's general responsiveness. In other words, work on response to discrete categories of stimuli could yeild better results if adjustments are made for each individual's general proclivity to respond to stimuli. We also encourage research on intermediate categories. For example, it would be useful to know if some people are more oriented to negative (including the specific categories of disgust, fear, disappointment, etc.) rather than to positive stimuli (satisfaction, happiness, contentment, etc.) and if this variation correlates with political activity. Future research should begin with the assumption that all methods of organizing stimuli are in play, from the broadest to the narrowest.

The breadth of our EDA responsiveness measure and the fact that it appears to correlate with political participation raises questions about whether it would correlate similarly with other types of life activities. Would it correlate with participation in religious activities? With participation in social organizations? With participation in choral societies and soccer clubs? Designing research to answer these questions would help to place politics in context. Is there something different regarding the competitive nature of politics that would render its connections to broad EDA responsiveness unique or does politics follow patterns similar to other life activities? In considering these possibilities, it should be noted that elevated responsiveness to stimuli is hardly an unadulterated positive. Many mental and emotional pathologies, including autism and schizophrenia, are thought to be linked to elevated sensory responsiveness (Baron-Cohen 2003). Perhaps future research in this area will want to be alert for the presence of non-linear relationships but the larger point is that it is clearly not the case that physiological responsiveness to environmental stimuli is merely a stand-in for overall good health—and apparently it is not merely a stand-in for general socioeconomic status (since income and education are controlled in our multivariate analyses and EDA responsiveness still registers an independent effect).

In sum, most likely without fully realizing it, certain people are more physiologiocally responsive than others to stimuli generally; moreover, variations in this degree of responsiveness are positively associated with involvement in the political arena. This simple finding leaves much unexplained, including the connection of broad EDA responsiveness to life activities other than politics and the extent to which this general effect is traceable to specific emotions. Though we have pitched this particular study at the broadest possible level of responsiveness, our suspicion is that each human is a unique combination of general responsiveness tendencies and responsiveness keyed to specific categories of stimuli. If we are correct that physiological concepts are able to measure in part the automatic, motivated, habitual, default, implicit, predisposed, biased, standing orientations that have been shown to undergird decisions, including political decisions, new research avenues will materialize since it would become possible to do more than merely acknowledge the importance of sub-threshold predispositions. Setting aside the complex factors that likely shape evolving physiological response patterns in the first place, value exists in recognizing that these physiological response patterns are the embodiment of the reasonably stable predispositions that are so central to people's political decisions and actions. Rather than merely noting that "when it come to politics, you've either got it or you don't" (Prior 2010) physiology may offer a way to begin to measure "it."

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Table 1. Descriptive Statistics for Model Variables

	Mean	Std. Deviation	Observations
2007			
Participation Index	7.200	4.210	37
Age	42.541	6.559	37
Income Level	3.811	1.469	37
Education Level	4.892	1.524	37
Gender	22 males	15 females	37
Δ Physiological Resp.	0.999	0.005	37
2008			
Participation Index	-.389	5.577	51
Age	41.216	8.259	51

Income Level	3.509	1.475	51
Education Level	4.333	1.322	51
Gender	23 Males	28 females	51
∆ Physiological Resp.	1.002	0.005	51

Table 2. OLS Models for Demographic and Physiological Variables

Variables	Model 1	Model 2	Model 3	Model 4
Age	0.008 (0.073)	0.009 (0.712)	0.100 (0.119)	-0.045 (0.092)
Female	-.410 (1.084)	-0.295 (1.060)	0.655 (1.464)	-0.447 (1.538)
Income	0.006 (0.400)	0.023 (0.391)	0.614 (0.540)	-0.606 (0.566)
Education	1.007* (0.406)	0.954* (0.398)	0.380 (0.476)	1.606* (0.622)
Phys. Responsiveness		0.225* (0.102)	0.254# (0.140)	0.261# (0.150)
2008	-6.955* (1.112)	-7.865* (1.163)		
Constant	2.491*	-221.694*	-256.142#	-264.024#

	(3.872)	(101.799)	(141.565)	(149.026)
Model Fit	.000	.000	.256	.059
R^2	.411	.45	.18	.21
Observations	88	88	37	51

Standard errors in parentheses
* p < .05

Table 3. OLS Model Interacting Education and Physiology

Variables	Participation
Age	0.032
	(0.073)
Female	-0.423
	(1.084)
Income	-0.138
	(0.395)
Education	0.035
	(0.603)
Phys. Responsiveness	$0.269^{\#}$
	(0.165)
Education * Physiology	$-0.209^{\#}$
	(0.115)
2008	-7.958^{*}
	(1.165)
Education * 2008	$-1.422^{\#}$
	(0.806)
Physiology * 2008	-0.017
	(0.219)
Education * Physiology * 2008	0.147
	(0.161)
Constant	7.342^{*}
	(3.314)

Model Fit	.000
R^2	.48
Observations	88

Interaction terms and their constituent parts are centered variables.
Standard errors in parentheses
* p < .05, # p < .10

Table 4. Logit Analyses

Variables	Register to Vote	Vote	Issue Vote	Campaign	Issue Position
Age	1.030	1.048	1.030	1.114	0.974
	(0.049)	(0.040)	(0.050)	(0.065)	(0.034)
Female	1.572	1.887	1.538	0.565	0.702
	(1.330)	(1.233)	(1.225)	(0.375)	(0.355)
Income	0.914	0.844	0.938	1.507	0.822
	(0.288)	(0.199)	(0.274)	(0.385)	(0.163)
Education	1.992*	1.565#	1.944*	0.830	1.575#
	(0.679)	(0.415)	(0.550)	(0.194)	(0.307)
Phys. Responsiveness	1.204#	1.194*	1.151#	1.173*	0.943
	(0.115)	(0.095)	(0.098)	(0.089)	(0.043)
2008	0.069*	0.023*	0.155*	0.275*	n/a[a]
	(0.089)	(0.028)	(0.147)	(0.214)	
χ^2	15.67	26.71	12.11	16.60	9.14
p	.016	.000	.000	.011	.104
Pseudo-R^2	.27	.30	.33	.22	.08
Observations	88	88	88	88	88

Coefficients are odds ratios. Standard errors in parentheses
* p < .05, # p < .10
[a] All participants in 2007 reported holding an issue position, thus variable *year* was omitted from this model.

Table 4 Continued.Logit Analyses

Variables	Donate	Contact Official	Persuade	Interest Group	Attend Meet.
Age	1.034	1.066	0.971	0.956	0.935
	(0.045)	(0.047)	(0.034)	(0.035)	(0.042)
Female	1.104	0.721	0.561	1.010	0.649
	(0.630)	(0.407)	(0.303)	(0.521)	(0.394)
Income	1.352	1.066	0.786	1.141	1.563#
	(0.287)	(0.222)	(0.163)	(0.215)	(0.370)
Education	1.006	1.329	1.776*	1.430#	1.072
	(0.214)	(0.276)	(0.386)	(0.285)	(0.245)
Phys. Responsiveness	1.047	1.162*	1.053	1.022	1.103#
	(0.054)	(0.070)	(0.055)	(0.049)	(0.064)
2008	0.165*	0.059*	0.079*	0.177*	0.109*
	(0.106)	(0.039)	(0.055)	(0.099)	(0.079)
χ^2	14.41	32.64	31.86	20.08	18.74
p	.025	.000	.000	.003	.005
Pseudo-R^2	.15	.29	.27	.18	.20
Observations	88	88	88	88	88